PROC. ENTOMOL. SOC. WASH.
102(4), 2000, pp. 929–956

A NEW GENUS OF THE OROBITIDINAE AND DISCUSSION OF ITS RELATIONSHIPS (COLEOPTERA: CURCULIONIDAE)

Boris A. Korotyaev, Alexander S. Konstantinov, and Charles W. O'Brien

(BAK) Zoological Institute, Russian Academy of Sciences, 199034 St. Petersburg, Russia; (ASK) Systematic Entomology Laboratory, PSI, Agricultural Research Service, U.S. Department of Agriculture, c/o National Museum of Natural History, Smithsonian Institution, Washington, DC 20560-0168, U.S.A. (e-mail: akonstan@sel.barc.usda.gov); (CWO) Center for Biological Control, Florida A&M University, Tallahassee, FL 32307-4100, U.S.A.

Abstract.—The new genus ***Parorobitis*** of the subfamily Orobitidinae and two **new species**, ***Parorobitis gibbus*** (Paraguay: Alto Parana) and ***Parorobitis minutus*** (Brazil: Curitiba, Parana), are described. The subfamily Orobitidinae is redescribed based on characters of *Orobitis* and *Parorobitis,* and diagnoses of the two genera are provided. Several characteristics of the head, thorax, wings and elytra are used to compare the Orobitidinae with the supposedly related taxa of Zygopinae, Ceutorhynchinae, and Baridinae. A key to these taxa is provided.

Key Words: Curculionidae, Orobitidinae, new taxa, South America

The subfamily Orobitidinae is comprised of two strikingly distinct genera. The Palearctic *Orobitis* Germar includes the transpalearctic *O. cyaneus* Linnaeus which develops in seed capsules of *Viola* spp. in broad-leaved and mixed forests and *O. nigrinus* Reitter from the Balkans. A new genus of this subfamily is described herein including a new species from Paraguay and another from Brazil.

These new taxa are described and an attempt is made to place them in the context of present-day weevil classification. In the last section of the paper, the close affinity of the newly described genus with the genus *Orobitis* and preliminary conclusions regarding the relationships of the Orobitidinae are presented. It is clear that examination of a much larger sample of taxa and characters in combination with rigorous analysis may be necessary to propose robust hypotheses of relationships.

As in many other beetle families, terminology of structures in weevils is fairly inconsistent and often is used in a misleading way (Thompson 1989). Although the subject of this paper is not comparative morphology or analysis of terminology, it is useful to provide a brief summary of the sources of terms for the most critical and disputed parts of the weevil body.

To describe metathoracic structures, a combination of terms proposed by Matsuda (1970) and McHugh et al. (1997) and the terms previously adapted for leaf beetles (Konstantinov and Vandenberg 1996) is used.

General wing terminology follows Kukalová-Peck and Lawrence (1993). Some unique structures of weevils were named by Zherikhin and Gratshev (1995). These terms are used for structures which were not named by Kukalová-Peck and Lawrence (1993). Terms of internal elytral

structures are those used by Lyal and King (1996).

Terms proposed by Thompson (1989) are used for the spermatheca. The term "pump," widely accepted to describe the same part of the spermathecal body attached to the lobe of the duct and lobe of gland (Smith 1979, Konstantinov 1998), is used instead of "tail." As for the other parts of the female genitalia, commonly accepted terms are used (Morimoto 1962, O'Brien and Askevold 1995, Howden 1995). Morimoto (1962), Lyal (1993), and O'Brien and Askevold (1995) are the main sources of the names used for different parts of the male genitalia.

Subfamily Orobitidinae

Description.—Body small, 2–3.5 mm long, globose or transversely-subrhomboidal, prothorax and elytra strongly conjointly convex (Figs. 1–4). Black; vestiture dense, tightly appressed and inconspicuous or suberect, composed of white and dark scales.

Rostrum as (Figs. 3–6, 8) long as or slightly longer than prothorax, basally weakly curved, apically straight; dorsal margin more or less angular in lateral view over antennal base. Apical part of rostrum in female (Fig. 5) much narrower than basal part. Ventral surface of head without posterior tentorial pits and occipital sutures. Subgenal sutures fused (Figs. 10, 11). Antenna inserted at basal third of rostrum (Figs. 3, 4, 8, 9). Antennal scrobe oblique, ventral margin reaching venter of rostrum less than half way between antennal insertion and eye. Scape stout, short, less than half as long as rather long and slender funicle with 7 antennomeres (Figs. 16, 17). Eye medium-sized, weakly convex. Frons as broad as base of rostrum or slightly narrower, sometimes weakly narrowing in middle.

Mandible (Figs. 12, 13, 15) ventrally with 2 visible denticles, third denticle covered with apex of rostrum; mandible dorsally separated from maxilla by long ventrolateral appendage of rostrum (Figs. 12, 15). Labial palpi 2- (*Parorobitis*) or 3- (*Orobitis*) segmented. Mentum long.

Prothorax subtrapezoidal with base very broadly rounded or nearly straight and slightly produced posteriorly for most of its length. Sides slightly rounded or nearly straight. Basal margins of prothorax and elytra tightly coupled, sometimes jointly raised, but not crenulate. Apical margin of pronotum not raised. Postocular lobes well developed to absent. Lateral tubercles absent. Disc of pronotum flat or moderately convex in apical half, without median sulcus. Prosternum excavated, not keeled in front of fore coxae. Distance between coxae nearly equal to width of rostrum. Mesepimeron not visible from above, flat, deeply inserted between base of prothorax and elytra (Figs. 18, 23). Rostral furrow formed by rather high, lamelliform keels behind fore coxae on prosternum, sometimes lower keels also present on mesosternum.

Mesoscutellum with tall stalk (Fig. 18). Mesosternum between middle and hind coxae with broad fold projecting over hind coxae. Mesosternum and metasternum fused. Internal ridge and border between these structures barely visible. Mesendosternite situated between internal wall of coxal cavity and mesosternal ridge. Plate nearly as long as wide. Basal and apical appendages slender (Fig. 19).

Scutoscutellar ridges of metanotum not connected, directed anteroventrally. Alocristal ridges not connected in middle (Fig. 20).

Metendosternite with moderately narrow stalk. Furcal arm slender, apically widening. Lateral arm short, situated nearly in middle of furcal arm. Anterior and posterior transverse ventral processes of equal length, leaving narrow furrow between (Figs. 21, 22).

Elytra slightly longer than broad, with strongly convex or obsolete humeral prominences. Elytra with locking sutural structure composed of deep longitudinal groove

1

Fig. 1. *Parorobitis gibbus*, ♂.

on left elytron (Fig. 18) and longitudinal ridge on right elytron (Fig. 27). Basal part of suture with two callosities and depressions between on left elytron. Right elytron with two depressions, and with ridge between them (Figs. 27, 28, 31, 32). Submarginal ridge of each elytron also complicated (Fig. 29, 30). Apex of elytron with longitudinal stridulatory file. Preapical groove absent (Figs. 35, 36).

Wings well-developed or slightly reduced, with well developed R, radial fissure, and first radial scelerite (Figs. 25, 26).[1]

Legs long. Femora broad from base, unarmed, subulate to moderately clavate, shallowly grooved for reception of tibiae. Tibiae (Figs. 39, 42, 43) in female not uncinate; in male, with short apical mucro (Figs.

[1] Zherikhin and Gratshev (1995) state that the Orobitini are wingless; however, *Orobitis cyaneus* has shortened but fairly well-developed wings (Fig. 26).

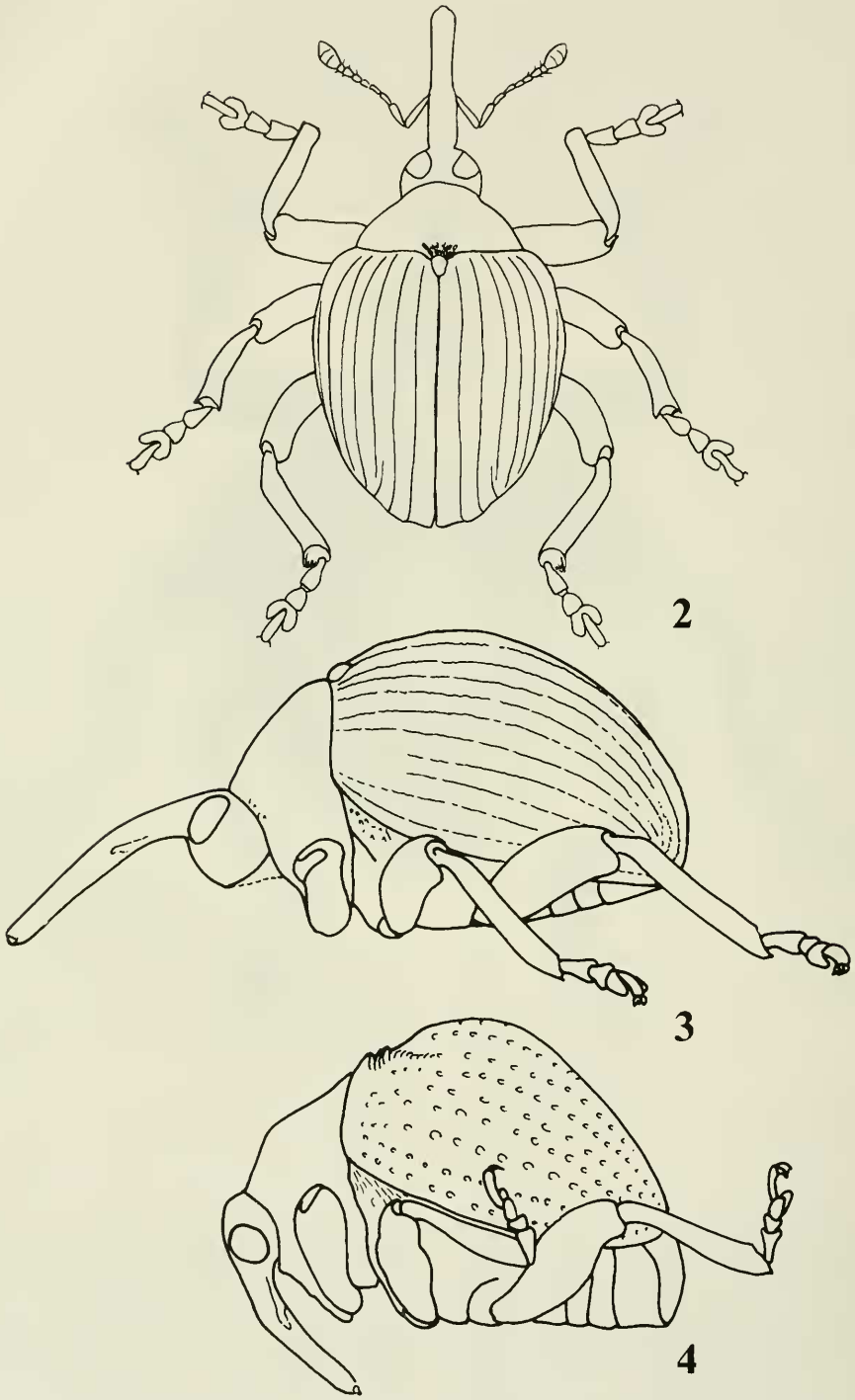


Fig. 2–4. 2, *Orobitis cyaneus*, ♂, dorsal view. 3, *O. cyaneus*, ♂, lateral view. 4, *Parorobitis gibbus*, ♂, lateral view.

40, 41). Apical comb of setae not or slightly extending onto outer margin of tibia. Third tarsomere bilobed. Claws separate, moderately divergent, with long median paired contiguous process (Figs. 46–48).

Abdomen with sterna in one plane. Sterna 1–4 of subequal length, 5 almost as long as sterna 3 and 4 together. Sternum 1 nearly completely divided by hind coxae. Hind margins of sterna 2–4 parallel, moderately curving backwards on sides (Fig. 23). Pleurite 1 long, separated from rest of tergum 1 by groove, attached by wide membrane with granulated microsculpture to metepisternum (Figs. 24). Pleura 4–7 combined with corresponding tergites. Tergum 8 exposed in males (Fig. 1).

Diagnoses of the two genera of the subfamily Orobitidinae

1 (2). Body subspherical, rounded. Humeral prominences obsolete. Basal margins of prothorax and elytra not raised (Figs. 2, 3). Dorsum almost uniformly covered with black or bluish black tightly appressed scales, shining. Dorsum of rostrum evenly curved over antennal base (Figs. 3, 9). Frons flat. Pronotum evenly convex, without median or lateral depressions. Basal margin of pronotum almost straight, imperceptibly notched opposite scutellum. Postocular lobes absent. Mesoscutellum rounded, as long as broad, weakly and evenly convex. Elytra longer than broad, all intervals flat, striae linear. Lateral margin of elytron slightly and almost evenly rounded, inconspicuously emarginate near base over mesepimera. Mesosternum without keels. Sides of meso- and metathorax evenly convex, without prominences or depressions. Fore coxa without prominence on inner side of apex. Femora nearly parallel-sided, with glabrous grooves ventrally. Claw short, length less than width of tarsomere 5 at apex (Fig. 48); median process ca. half as long as claw. Abdominal suture 1 without lateral pore. Sterna uniformly covered with yellowish scales. 2-2.8 mm. Palearctic. Larvae in seed capsules of *Viola* spp. . . . . *Orobitis* Germar

2 (1). Body subrhomboidal, angular humeral prominence convex, forming broad, moderately curved callus (Figs. 1, 4). Basal margins of both prothorax and elytra both finely conjointly raised. Dorsum with pale and dark brown spots on pronotum and contrasting basal band on elytra, with background vestiture composed of dense suberect to subappressed, linear to lanceolate, white scales. Rostral dorsum angular over antennal insertion (Figs. 4, 8). Frons moderately depressed, anterior part sloping to base of rostrum and posterior part, to vertex. Pronotum with two submedian obtuse prominences in apical half; laterally uneven. Basal margin of pronotum notched in middle and bisinuate laterally. Postocular lobes from well- to poorly developed. Mesoscutellum longer than wide, large, tuberculiform, steeply sloping anteriorly and gradually sloping to elytra. Elytra broader than long. Odd-numbered intervals weakly to moderately convex, costiform near base. Striae consisting of medium-sized, deep, remote punctures, space between latter undulate. Intervals very densely, finely punctate, nearly matt. Lateral margin of elytron moderately deeply emarginate over mesepimeron, very shallowly bisinuate behind. Mesosternum with well-developed keels reaching middle coxae. Fore coxa with obtuse prominence at apex, separated laterally by narrow sulcus. Femora distinctly clavate, with shallow grooves on ventral side, all uniformly covered with scales. Claws long, length greater than width of last-tarsomere at apex (Figs. 46, 47); median process slightly shorter than claws. Abdominal suture 1 with lateral pore under brown scaly spot. Pleural area of thorax with brown spots. 2.9–3.5 mm.. Neotropical . . . . . *Parorobitis,* new genus

Parorobitis Korotyaev, O'Brien, and Konstantinov, new genus

Type species.—*Parorobitis gibbus,* new species.

Description.—Small; body short, subrhomboidal, dorsally strongly convex; prothorax and elytra conjointly convex. Body black, densely clothed with suberect to subappressed, elongate scales, dorsally with contrasting pattern of white and brown scales. Black, funicle and club of antennae and apical third of rostrum brown, tarsomere 3 dark brown.

Head capsule small. Rostrum angularly curved at antennal base, ventrally weakly arcuate, with dorsum more (in female) or less (in male) sharply angular (Figs. 4, 8).

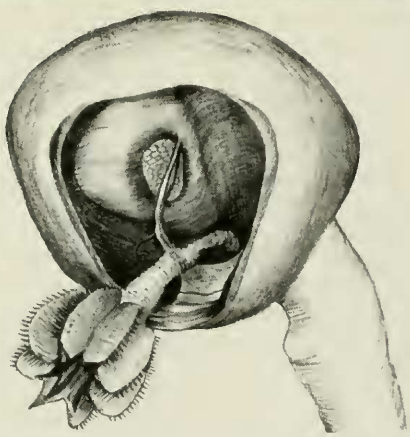
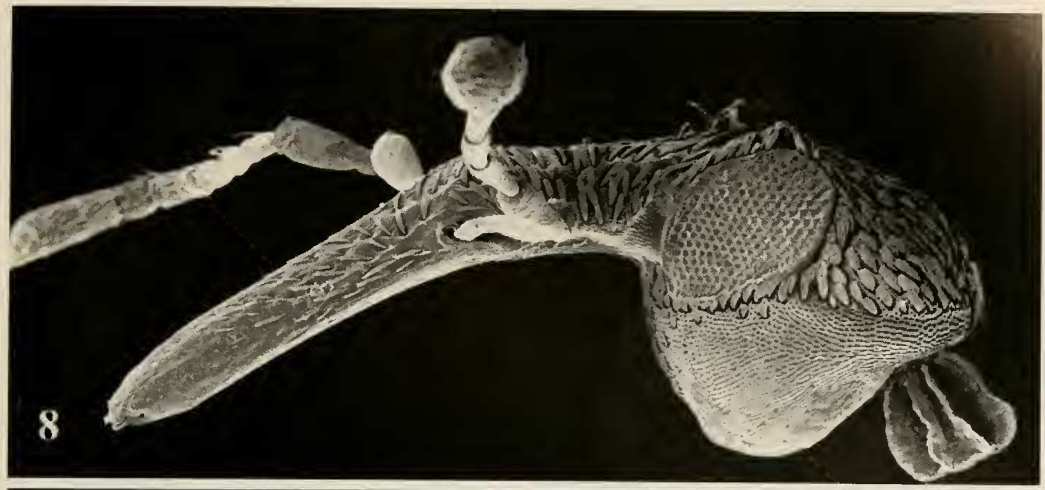
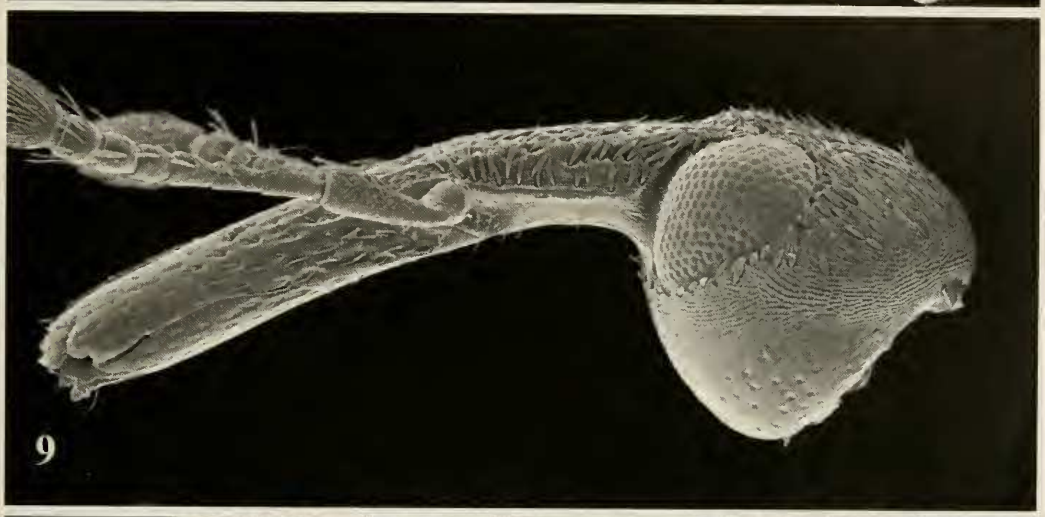
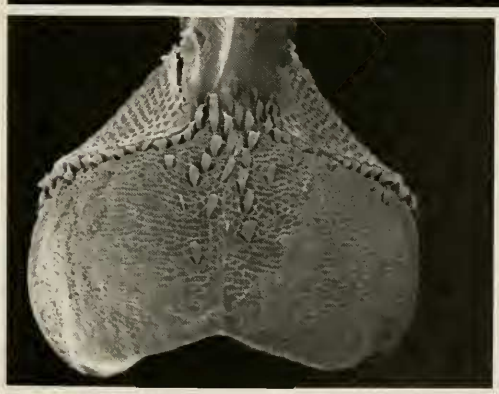


Fig. 5–7. Head. 5, *Parorobitis gibbus,* ♂, frontal view. 6, *Orobitis cyaneus,* ♂, frontal view. 7, *P. gibbus,* view through occipital opening, tentorium and foregut with proventriculus.







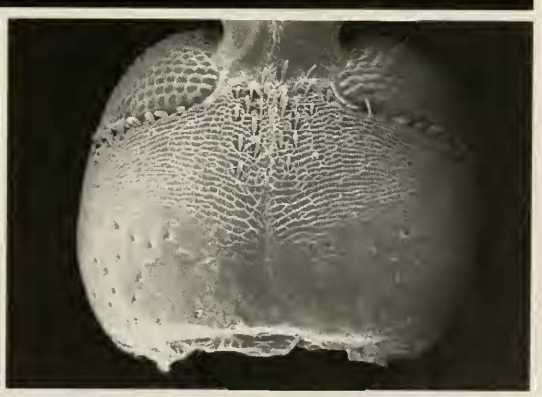


Fig. 8–11. Head, ♂. 8, 9, Lateral view. 10, 11, Ventral view. 8, 10, *Parorobitis gibbus*. 9, 11, *Orobitis cyaneus*.

Basal part of rostrum broader than apical (Fig. 5), nearly as broad as fore tibia. Apical part narrower (Fig. 5); in female, straight, cylindrical, shining. Antenna inserted at basal third of rostrum. Scape short, stout. Funicle long, antennomeres progressively shorter apically; club oval, short (Figs. 5, 16). Eyes strongly anteriorly directed. Frons at anterior margin as broad as base of rostrum, widened posteriorly, weakly depressed, slightly, transversely ridged in middle. Vertex weakly convex, not carinate. Sculpture fine. Tentorium well-developed, with moderately broad long stalk attached to ventral surface of head and two lateral branches attached to anteromedial corner of eye (Fig. 7). [It is unclear if these branches are homologous with anterior or dorsal arms.] Foregut with 8-laminate chitinized proventriculus (Fig. 7, 14). [According to Crowson (1955) this structure may well be plesiomorphic for curculionids. It is also known to occur in Cossoninae (*Caulophilus latinasus* Say) (Crowson, 1955), Baridini (*Pachybaris porosus* Lec.) (in the latter species it is much longer and all the laminae are lower), and Zygopini (*Lobotrachelus subfasciatus* Motschulsky) (it is generally shorter with every lamina being taller posteriorly and shorter anteriorly).]

Left mandible with ventral denticles closer together than on right mandible. Labial palpus 2-segmented. Sides of mentum convex (Fig. 12).

Prothorax transverse, trapezoidal. Base sinuate, noticeably produced posteriorly and enclosed by humeral prominences of elytra, shallowly notched anterior to scutellum and bisinuate laterally. Apical margin of pronotum raised. Basal margin raised to meet raised basal margin of elytra, finely carinate. Hind angles weakly projecting, sides weakly convex and strongly converging to apical prominences immediately above postocular lobes. Apical constriction moderately deep on dorsum and gradually disappearing towards prominences, which slope to anterior margin of prothorax. Sides near anterior margin with two angular prominences visible in dorsal view. Punctures on disc dense, uniform, medium-sized, rather deep; intervals between punctures shining, narrow. Ocular lobe well-developed, angular. Fore coxae separated by width of rostrum. Prosternum in front of coxae not keeled, as long as width of rostrum at base, deeply excavated, with moderately high lamelliform keels behind coxae.

Mesothorax short, transverse (Figs. 18, 19). Mesosternum with keels reaching anteromedial margin of middle coxae. In lateral view, mesosternum rather steeply declivous to metasternum. Scutellum large, strongly convex, broadly rounded on top. Mesepimeron separated from mesocoxa by mesosternal appendage (Fig. 23). Mesepimeron not visible from above, although entering deeply between bases of prothorax and elytron. Distance between mesocoxae greater than width of coxa.

Metathorax much longer than mesothorax (Fig. 18). Metanotal prescutal membrane thin and vertical. Alocrista moderately narrow, without well-developed lateral ridge. Scutum well separated by scutoscutellar groove forming large "pocket" laterally, nearly as large as scutellum. Ventrally, scutoscutellar ridge forming wide plate directed anteroventrally and dividing metanotal cavity into two almost equal-sized compartments (Fig. 20). Scutellar groove ending at basal margin of notum. Allocristal part of notum containing dorsally and ventrally separated cavity with two elongate openings. Axillary part of metanotum situated anterolaterad of scutum. Part of scutum connected with axillary area forming nearly parallel-sided, wide, weakly sclerotized appendage. Metasternum forming thick fold over hind coxa. Hind coxae separated from elytra by slightly less than width of coxa. Metepisternum convex.

Elytra much broader than pronotum, transverse, strongly narrowing apically, with unusually convex humeral prominences, separately and rather narrowly rounded at apices, and extending over base of py-

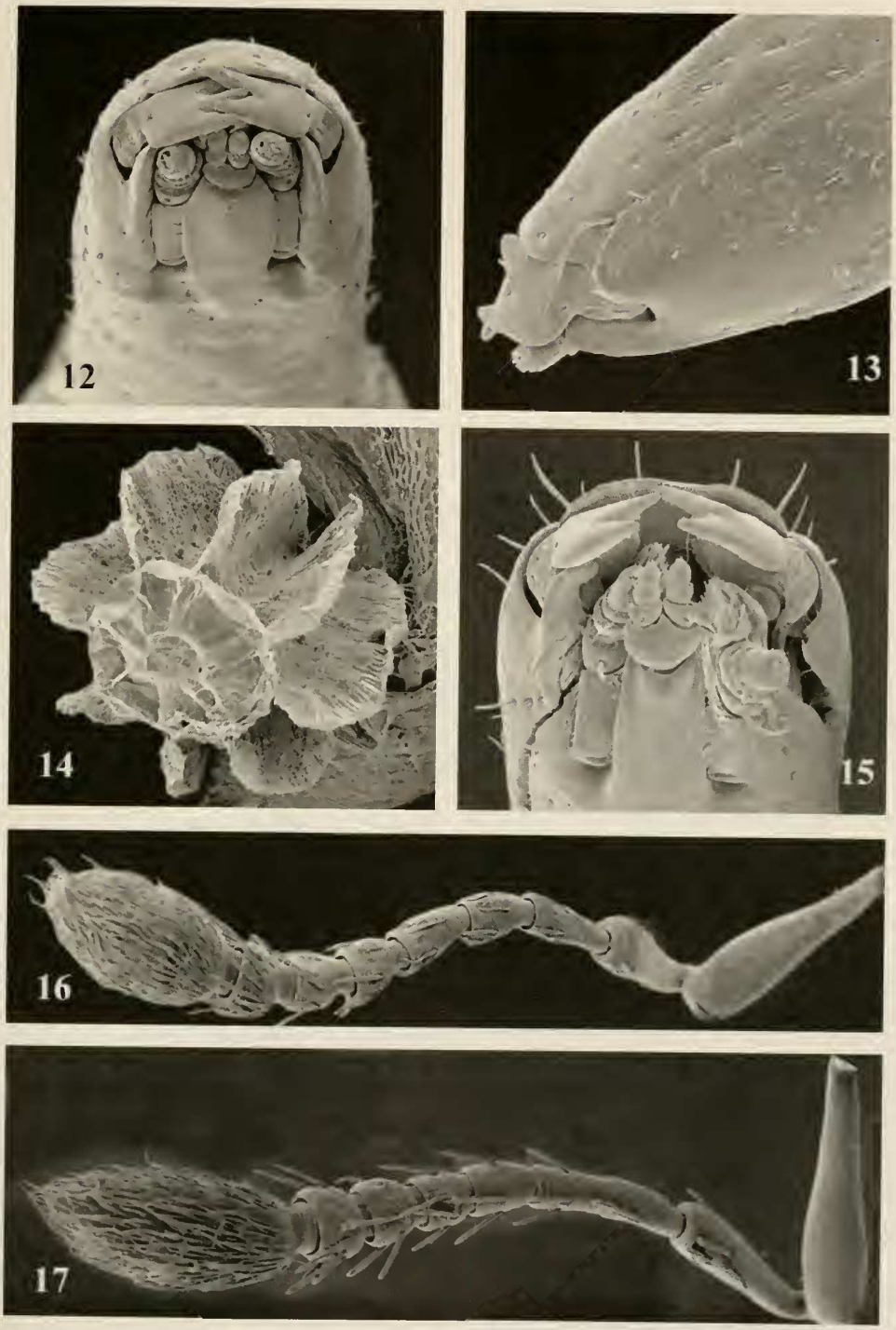


Fig. 12–17. 12–14, 16, *Parorobitis gibbus*, ♂. 15, 17, *Orobitis cyaneus*, ♂. 12, Mouth parts, ventral view, 13, Tip of head, lateral view. 14, Proventriculus. 15, Mouth parts. 16, 17, Antenna.

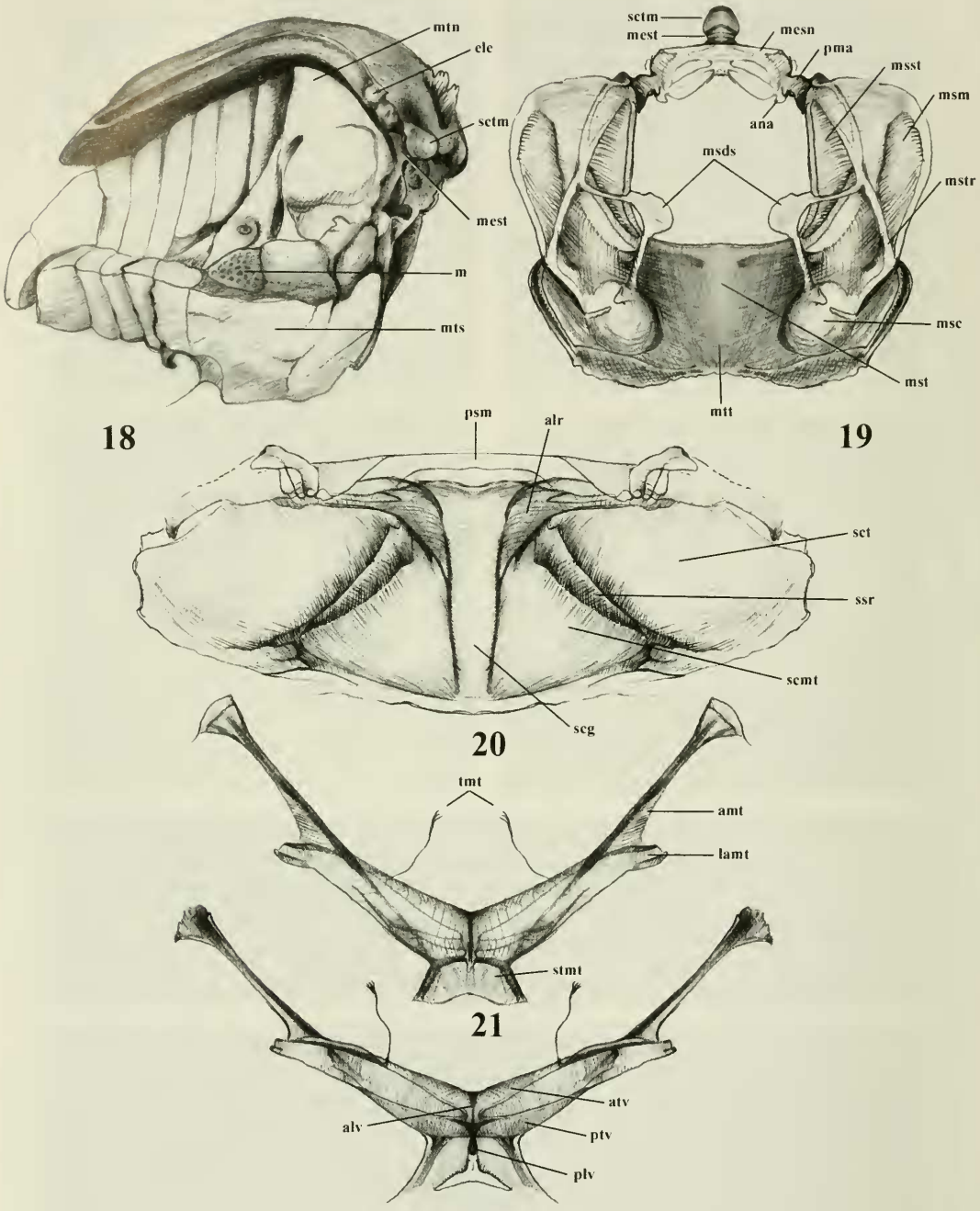


Fig. 18–22. Thoracic structures of *Parorobitis gibbus*. 18, Lateral view with right elytron removed. 19, Mesothorax and metasternum (metanotum removed), view of internal structures. 20, Metanotum, ventral view. 21, 22, Metendosternite (21, dorsal view; 22, ventral view). Abbreviations: alr = allocrista; alv = anterior part of longitudinal ventral process; amt = furcal arm; ana = anterior notal appendage; atv = anterior part of transverse ventral process; elc = elytral lock; lamt = lateral arm; m = membrane; mesn = mesonotum; mest = stalk of mesoscutellum; msc = mesocoxal cavity; msds = mesendosternite; msm = mesepimeron; msst = mesepisternum; mst = mesosternum; mstr = merosternal ridge; mtn = metanotum; mts = metepisternum; mtt = metasternum; plv = posterior part of longitudinal ventral process; pma = postmedial appendage; psm =

gidium. Lateral margin of elytron emarginate at base and very shallowly bisinuate posteriorly. Internal surface with four longitudinal striae of tiny denticles (Fig. 27). Right elytron with locking structure consisting of narrow ridge and two nearly round lateral impressions. Elytral apex covered with multidentate median callosities. Middle of apex with patch of medially directed setae (Figs. 27, 31). Striae composed of medium-sized, rather deep, sparse, round punctures. Intervals 3–4 times as broad as striae; odd-numbered intervals weakly to strongly convex, densely covered with small shallow punctures.

Wing elongate, with apex slightly darker than middle. Humeral field with short C not touching Sc. R straight, widening apically. Radial fissure indistinct. Radial fold weak. First radial sclerite well-developed and large, second small. Rr absent. Anal field with two weakly developed anal veins (Fig. 25).

Legs long, stout. Trochanters short. Femora broad from base, moderately clavate, with deep ventral constriction near apex. Shallow ventral groove in apical half covered with scales as elsewhere. Hind femur more swollen in apical part than fore and middle femora. Tibiae weakly broadening and curved outward apically; fore and middle tibiae slightly flattened, hind tibia nearly round in cross-section, medially and frontally compressed apically (Fig. 31). In female, tibiae mutic; in male, all armed with small curved mucro (Figs. 39–41).

Apical fringe of setae slightly oblique only to outer margin of tibia. Setae dense, fine and short. Tarsi of medium proportions, tarsomere 3 bilobed, nearly twice as broad as 2. Tarsomere 5 moderately widening apically, slightly more than half length extending beyond lobes of tarsomere 3. Claws large, with transversely flattened, longitudinally curved, apically subacute to acute, median process, latter slightly shorter than claws (Figs. 46, 47).

Venter weakly concave in female and more strongly so in male. Sterna 1–4 short, nearly equal in length. Sternum 5 nearly twice as long as sternum 4 (Fig. 23). Small indentation between sterna 1 and 2, slightly smaller indentations between other sterna, with latter indentations slightly more medial. Abdominal terga 1–5 short, nearly equal in length. Tergum 6 much shorter in middle. Tergum 7 slightly longer than terga 4, 5 and 6 together (Fig. 24). Tergite 8 of male with long basal projections (Fig. 57, 60).

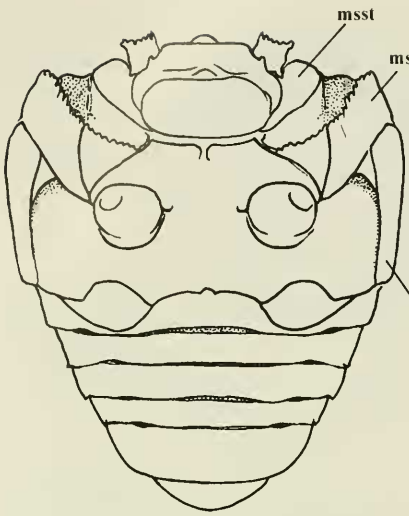
Male genitalia: Apodemes longer than upper part of median lobe. Apical [third? fourth] of median lobe bent ventrally, gradually narrowing apicad. Spiculum gastrale long, attached to membrane of tegmen between sclerotized parts of sternum 8 (Figs. 57–62).

Female genitalia: Tergum 8 elongate, weakly sclerotized medially, with moderately well-sclerotized stripe along border. Sternum 8 with two patches of long setae apically and short setae between sclerotized arms (Fig. 51). Vagina narrow. Coxite and stylus narrow, at rest situated inside vagina (Figs. 53, 55). Spermatheca with well-developed gland and ductal lobes, receptacle more than 4× as long as wide (Figs. 52, 56).

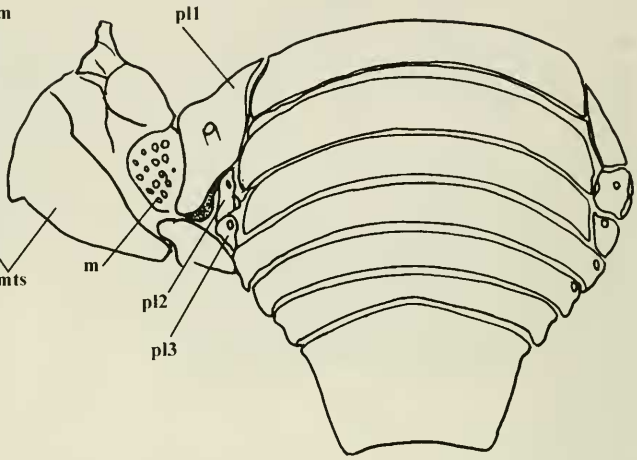
Etymology.—This masculine generic name is the result of combining the generic name *Orobitis* and the Greek prefix *para-* meaning "close by, or similar to" and reflects the morphological similarity and close relationship of these two genera.

←

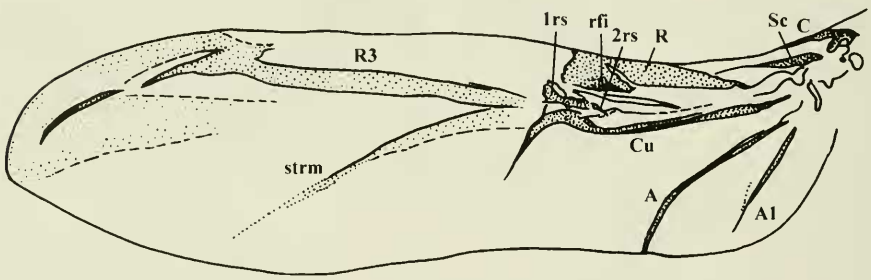
prescutal membrane; ptv = posterior part of transverse ventral process; scg = scutellar groove; scmt = metascutellum; sct = metascutum; sctm = mesoscutellum; ssr = scutoscutellar ridge; stmt = furcal stalk; tmt = tendons of meso- metafurcal muscles.



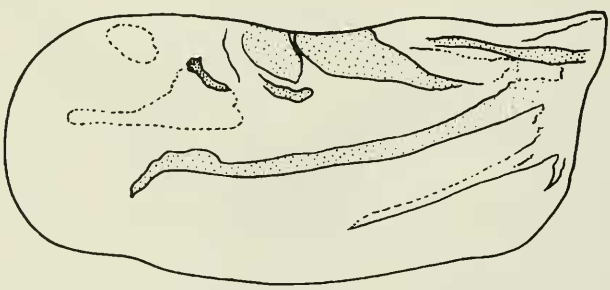
23



24



25



26

Fig. 23–26. 23–25, *Parorobitis gibbus*. 23, Meso- and metasternum and abdominal sternites. 24, Abdominal tergites, pleurites, and metepisternum. 25, Wing. 26, *Orobitis cyaneus*, wing. Abbreviations: 1rs, 2rs = radial sclerites; m = membrane; msm = mesepimeron; msst = mesepisternum; p11, 2, and 3 = abdominal pleurites; rfi = radial fissure; strm = medial stripe.

***Pararobitis gibbus* Korotyaev, O'Brien, and Konstantinov, new species**
(Figs. 1, 4, 5, 7, 8, 12–14, 16, 18–25, 27, 29, 31, 35, 39–41, 46, 47, 51–53, 57–59)

Types.—Holotype ♂, Paraguay, Puerto P. Stroessner, 26–28.XII.1965, Nr. P. 9 (Mahunka), HMNH. Paratypes. 2 ♂, 2 ♀, same data as holotype (♂, ♀ HMNH, ♂ USNM, ♀ ZMAS). Paratypes. ♂, ♀, Paraguay: Alto Parana, 6 km W. Pto. Pres. Stroessner: 25–28.I.1983, leg. E. G. Riley (CWOB)

Description.—*Male:* Rostrum nearly as long as pronotum, with maximum width at antennal insertion, tapering basally and apically in dorsal view. Dorsal surface with sharp median carina disappearing before apex (Fig. 5). Lateral carina better developed between antennal insertion and head. Space between median and lateral carinae with row of deep punctures. Weak carinae converging on sides above antennal insertion, but vanishing separately near apex. Antenna inserted 0.35 from base of rostrum (Fig. 8). Scape shorter than funicular antennomeres 1 and 2 together, not reaching eye. Funicle rather slender and long, antennomeres progressively becoming shorter, antennomeres 5 and 6 slightly longer than wide, antennomere 7 globose. Club oval, short. Setae on flagellomeres moderately long, suberect.

Prothorax 1.65× as broad as long. Postocular lobe large, angular. Disc moderately convex, with two broad obtuse prominences in apical half, separated by shallow longitudinal depression not extending to basal half of disc. Sides of disc with rather deep round fovea postero-lateral to apical discal prominences, and with shallower fovea behind anterolateral prominences. Scutellum large, 1.4× as long as broad, rounded, very strongly convex, with steep anterior slope and gentle posterior slope to level of elytral suture. Surface of scutellum concealed by pale, sand-brown, imbricate scales.

Elytra 1.2× as broad as long, 1.6× as broad as base of prothorax, very strongly narrowing apically, with very strongly convex rounded humeral prominences. Disc strongly convex, more steeply sloping to base than to apex. Base of elytra deeply foveate along basal half of scutellum. Elytral striae with medium-sized, deep, sparse punctures. Stria 1 at base parallel to antescutellar margin of elytron and meeting incurved base of stria 2. Striae 3–6 nearly straight at base, stria 7 vanishing near the posterior margin of swollen interval 7, stria 8 reaching basal half of humeral prominence. Intervals 2 and 4 rather strongly convex, interval 6 depressed at base, becoming gradually more convex apically. Interval 8 in apical two-thirds slightly more convex than others. Preapical prominence obtuse and not very convex, stria beneath prominence deepened. Intervals matt, densely and finely punctate, lacking granulations.

Femora moderately swollen apically. Tibiae inconspicuously widening and apically curved outward. Mucro on middle and hind tibiae slightly shorter than tarsal claws; on fore tibia, half as long and much finer (Figs. 39–41). Protarsomere one about 1.7× as long as broad, protarsomere two 1.3× as long as broad, protarsomere three 0.8× as long as broad, 1.1× as long as 2. Tarsomere 5 weakly broadened apically, by two-thirds of length extending beyond lobes of tarsomere 3. Punctures on femora dense, deep, medium-sized, round; on tibiae, more or less elongate. Median claw process ca. twice as broad as claw (Figs. 46, 47).

Anal sternum flattened in middle one-third and covered with suberect to erect white hairs, sterna 3 and 4 with long, narrow, curved, suberect white scales along hind margin. Pygidium rounded, weakly transverse and raised along median line, coarsely punctate, and moderately densely covered with elongate suberect white scales.

Genitalia (Figs. 57–59): Median lobe narrowing apically, abruptly widening horizontally. Apical third with lateral patches

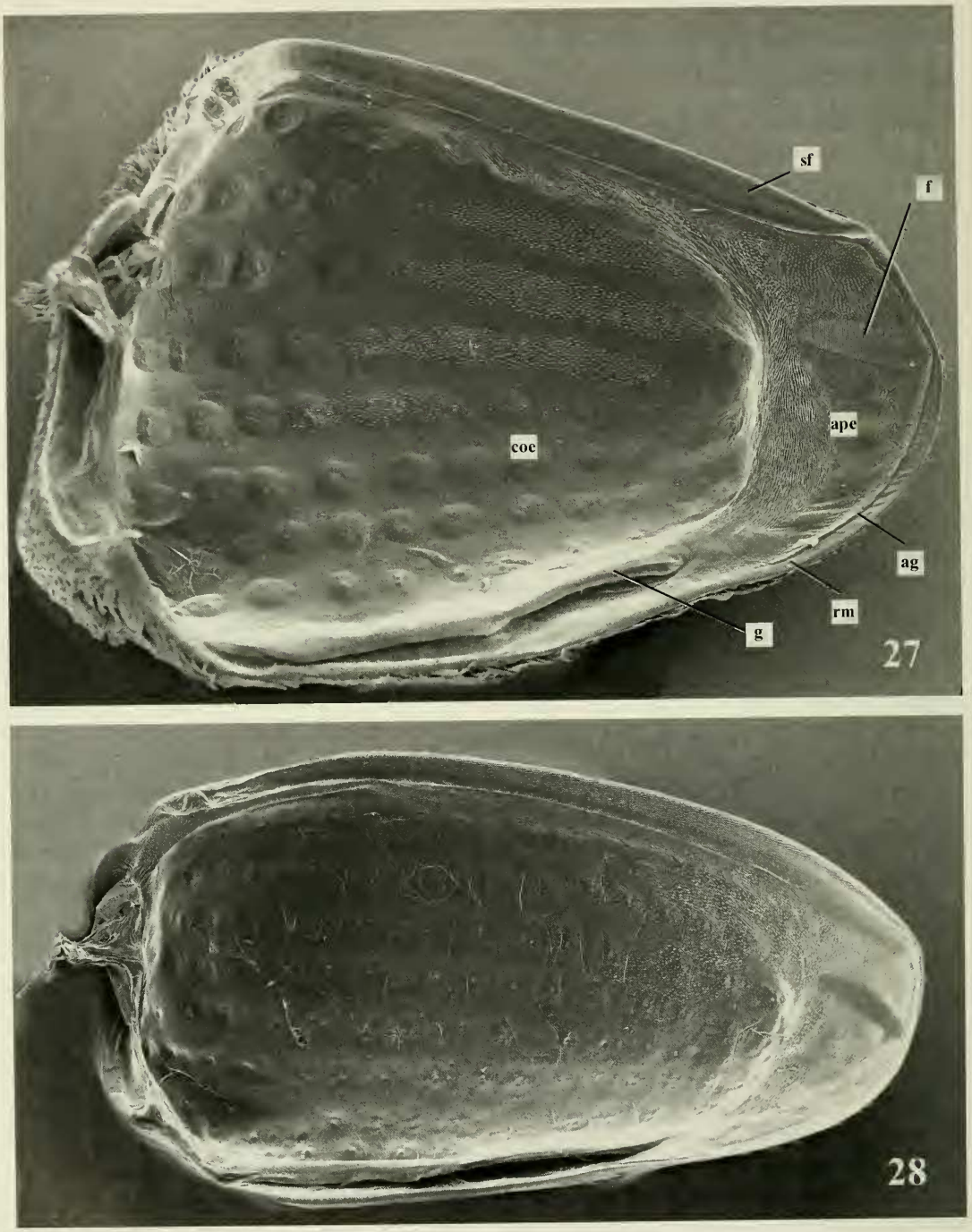


Fig. 27–28. Internal surface of right elytron. 27, *Parorobitis gibbus*. 28, *Orobitis cyaneus*. Abbreviations: ag = apical groove of elytron; ape = apical area of elytron; coe = concave area of elyton; f = file; g = submarginal ridge; rm = rim; sf = sutural flange.

of setae. Apodeme curved laterally, widening before base.

Head capsule densely covered with parallel-sided or weakly rounded, broad scales; vertex with few narrower brown scales in middle, and piceous scales on hind margin, otherwise with white scales. Basal part of rostrum with moderately dense white scales, latter half as broad as on vertex, rapidly thinning to antennal insetion; rostrum distally with sparse hair-like scales along sides to slightly beyond middle. Pronotum with moderately dense, narrow-lanceolate, brown scales in middle of disc; median depression with paler scales, often with few white scales on bottom. Brown spots on discal prominences and near base surrounded by narrow gray lines moderately densely covered with hair-like white scales; latter also covering sides of prothorax to angular line formed by broad white scales, nearly concealing pleural area and fore coxa. Anterior slope of discal prominences densely covered with narrower white scales; apical constriction with two gray spots, formed by narrow white scales. Sides also with small spot of brown scales between hind angles and lateral depression. Scutellum dull pale brown apically, with white scales at base. Base of elytra with band of brown scales; intervals 1 and 2, preapical prominences and sides in apical half densely covered with broad white scales; middle of each elytron with sparser vestiture of white, linear to narrow-lanceolate scales, latter broader in striae. Legs mottled with spots of narrow and broad white scales, sternum 1 and base of sternum 2 with brown spot on sides. Pygidium with scales not extending from punctures, broadly oval to round in basal half and elongate, slightly raised near apex; brown scales predominant in basal half; with white scales, along margins, median line, and in apical half.

Body length 3.1–3.3, width 3 mm.

Female: Rostrum 1.25× as long as prothorax, moderately widened and angularly curved at antennal insetion, with dorsal outline angular in lateral view; in apical part, straight, cylindrical, slender, about ⅔ width of fore tibia. Basal half of rostrum matt, densely covered with small shallow punctures. Median carina well developed, extending considerably beyond antennal base; lateral carinae finer. Sides of rostrum with pair of carinae converging apically from antennal base to middle of apical part of rostrum. Antennae inserted 0.3 from base of rostrum.

Tibiae without mucro. Protarsomere 1 about 1.6 as long as broad, protarsomere 2 nearly as long as broad, protarsomere 3 twice as long as 2.

Anal sternum flat. Pygidium slightly longer than broad, weakly and rather evenly convex, slightly raised along median line in apical third, narrowly rounded at apex, matt, moderately densely covered with medium-sized, fairly deep punctures.

Scutellum dull pale brown.

Female genitalia: Arms of sternum 8 moderately long (Fig. 51). Coxite and stylus slender (Fig. 53), latter nearly cylindrical. Spermathecal pump and ductal lobe forming broad loop. Apex of spermathecal pump bent toward ductal lobe (Fig. 52).

Remarks.—*Parorobitis gibbus* shares most character states with *P. minutus*. It can be separated by the whiter scale pattern of the head, larger size, longer arms of sternum 8 (Fig. 51), the slender coxite and stylus (Fig. 53), the stylus nearly cylindrical, the spermathecal pump and ductal lobe forming a moderately wide loop, the apex of the spermathecal pump bent toward the ductal lobe (Fig. 52), the median lobe narrowing apically with abrupt widening at the horizontal part, the apical third with lateral patches of setae, and the apodeme widening apically (Fig. 57–59).

Etymology.—This specific epithet is based on the Latin adjective *gibbus* = "humpbacked, protuberant" and refers to the humpbacked appearance and the two well-developed pronotal protuberances or swellings.

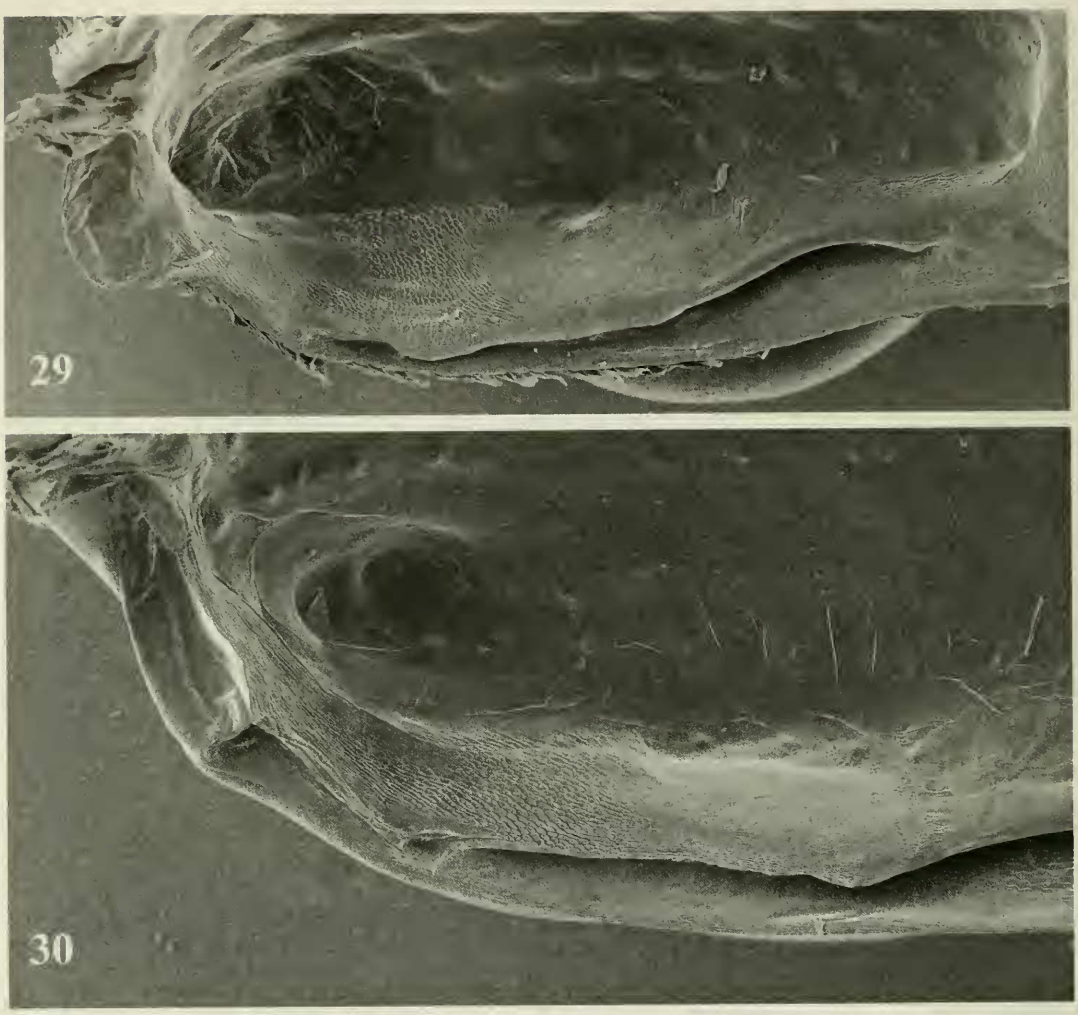


Fig. 29–30. Internal surface of right elytron, anterolateral part. 29, *Parorobitis gibbus*. 30, *Orobitis cyaneus*.

Parorobitis minutus O'Brien, Korotyaev, and Konstantinov, new species

(Figs. 54–56, 60–62)

Types.—Holotype ♂, Brazil, Curitiba, Parana, I.13.1969, Araucaria forest, leg. C. W. & L. B. O'Brien (OZUP). Paratype ♀, same data as holotype (CWOB).

Description.—*Male:* Rostrum slightly longer than pronotum, with maximum width at antennal insertion, tapering basally and apically in dorsal view. Dorsal surface with sharp median carina disappearing in front of apex. Lateral carina better developed between antennal insertion and head. Space between median and lateral carinae without punctures, covered with longitudinal wrinkles. Lateral carinae above antennal insertion parallel to each other, vanishing near apex. Antenna inserted 0.37 from base of rostrum. Scape shorter than funicular antennomeres 1 and 2 together, not reaching eye. Funicle rather slender and long, antennomeres progressively becoming shorter, antennomeres 5 and 6 slightly longer than wide, antennomere 7 globose. Club oval, short. Setae on flagellomeres long, suberect.

Prothorax 1.67× as broad as long. Postocular lobe weakly developed. Disc moderately convex, with single obtuse prominence in middle. Lateral areas of disc with-

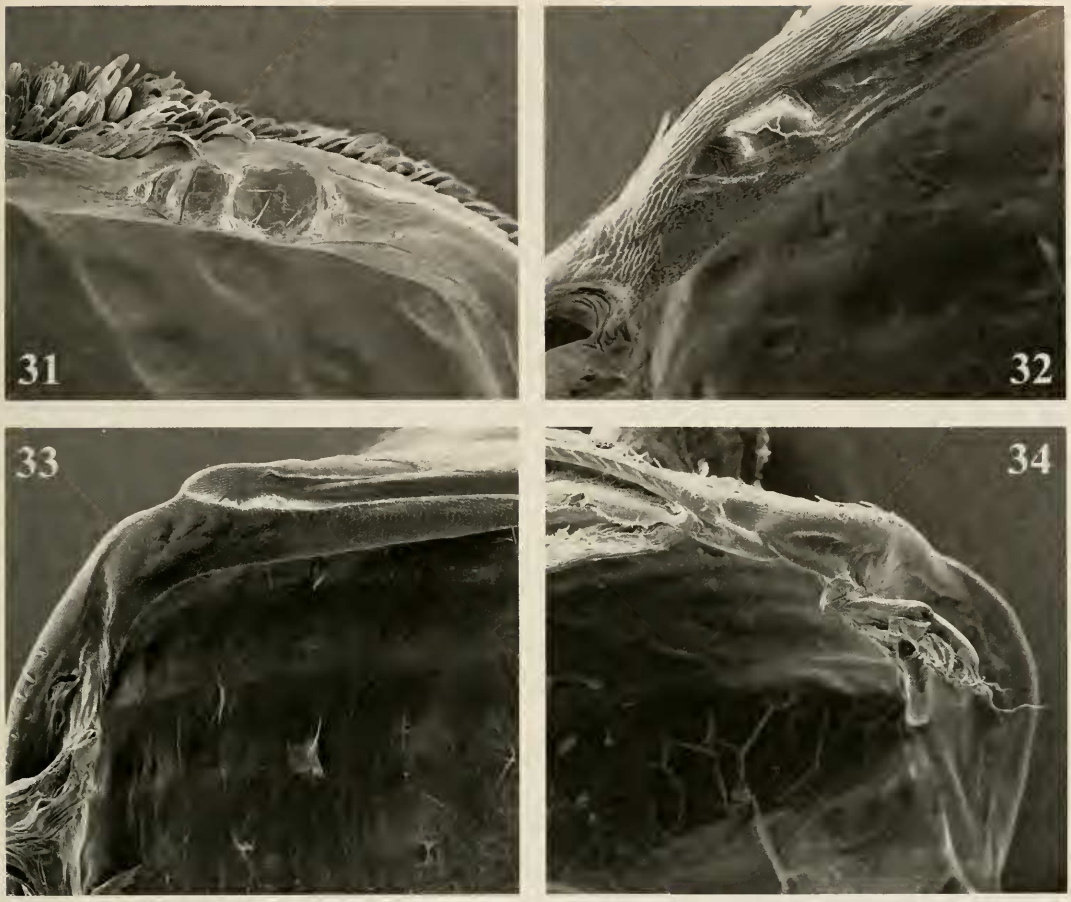


Fig. 31–34. Lock structures of elytron. 31, *Parorobitis gibbus*. 32, *Orobitis cyaneus*. 33, *Pachybaris porosa*. 34, *Lobotrachelus subfasciatus* (left elytron).

out deep fovea, with laterobasal prominence.

Scutellum large, 1.67× as long as broad, very strongly, roundly convex, with steep anterior slope and posterior slope leveling to elytral suture. Surface of scutellum concealed by brownish (in male) or pale sandbrown (in female) imbricate scales.

Elytra together 1.2× as broad as long, 1.69× as broad as base of prothorax, strongly narrowing apically, with very strongly convex, rounded humeral prominences. Disc strongly convex, more steeply sloping to base than to apex. Base of elytra deeply foveate along basal half of scutellum. Strial punctures small, moderately deep, sparse, nearly entirely covered with scales. Stria 1 parallel at base to antescutellar margin of elytron, meeting incurved base of stria 2. Striae 3–6 nearly straight at base, stria 7 vanishing in front of preapical callosity, stria 8 reaching basal half of humeral prominence. Intervals 2–6 equally convex; intervals 5 and 6 flattening apically; interval 8 in apical two-thirds nearly as convex as adjacent intervals. Preapical prominence convex, stria beneath prominence deepened. Surface of intervals matt, densely and finely punctate, lacking granulation.

Femora moderately swollen apically. Tibiae inconspicuously widening and apically curved outward. Mucro on middle and hind tibiae slightly shorter than tarsal claw;

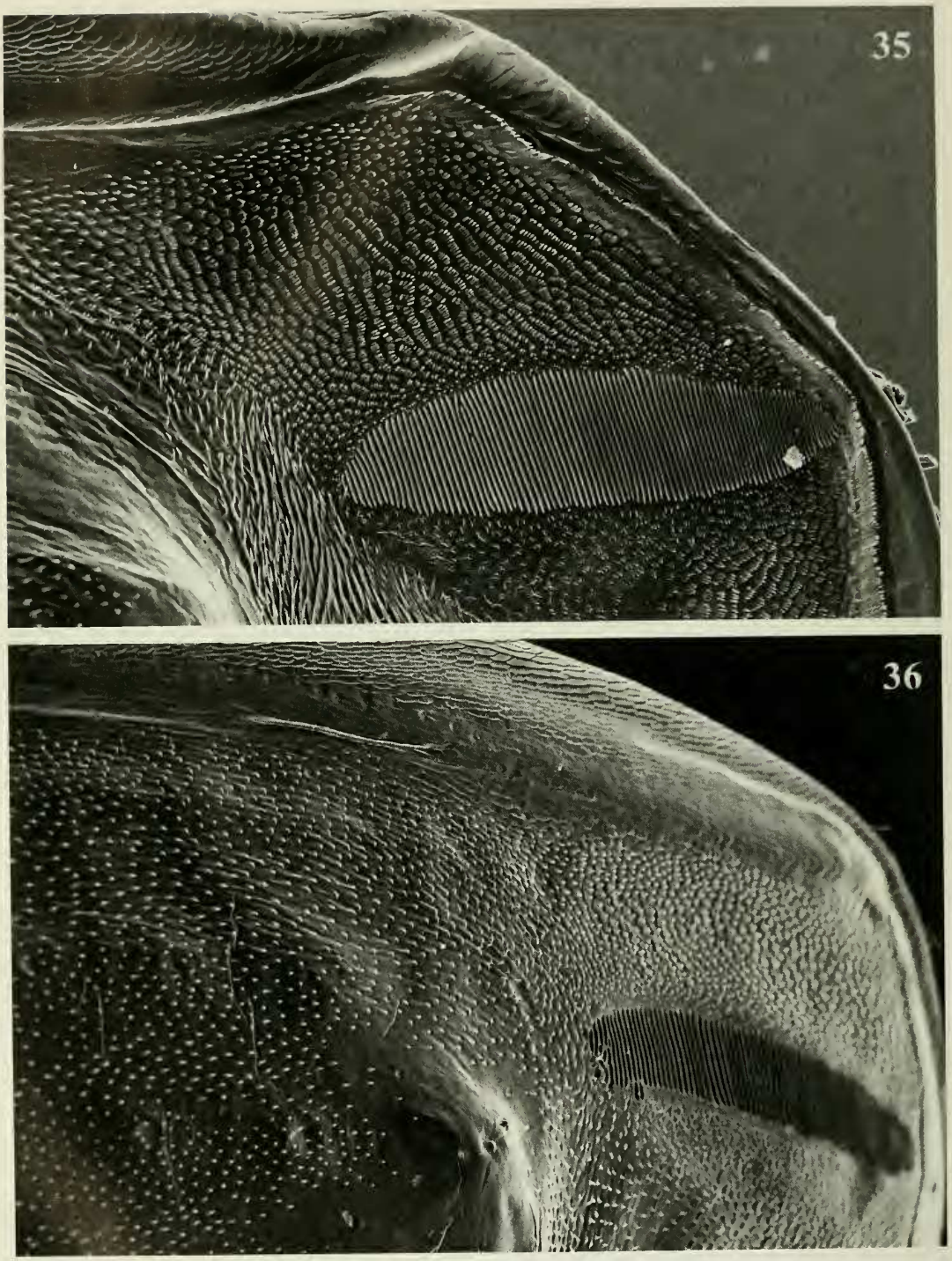


Fig. 35–36. Elytral apex with stridulatory file. 35, *Parorobitis gibbus*. 36, *Orobitis cyaneus*.

on fore tibia, mucro tiny, scarcely visible. Protarsomere one about 2× as long as broad, protarsomere two 1.2× as long as broad, protarsomere three 0.72× as long as broad, 1.3× as long as protarsomere two; protarsomere five weakly widened apically, extending two-thirds beyond lobes of protarsomere 3. Punctures on femora dense, deep, medium-sized, round; on tibiae, more or less elongate. Tarsal claws with median process ca. as broad as claw.

Anal sternum flattened in middle and covered with suberect to erect white hairs, ventrites 3 and 4 with long, narrow, curved, suberect white scales along hind margin. Pygidium rounded, weakly transverse and raised along median line, coarsely punctate, and moderately densely covered with elongate suberect white scales.

Male genitalia (Figs. 57–59): Median lobe narrowing apically without abrupt widening horizontally. Apical third without lateral patches of setae. Apodeme at base nearly as broad as at apex.

Head capsule densely covered with parallel-sided or weakly rounded broad scales; vertex with two stripes of narrow brown scales in middle, and piceous scales at hind margin, otherwise with white scales. Basal part of rostrum with moderately dense white scales half as broad as those on vertex, rapidly thinning to antennal insertion; rostrum distally with sparse hair-like scales along sides to slightly beyond middle. Pronotum with moderately dense, narrow-lanceolate, brown scales on disc and paler scales in middle, with narrow transverse stripe of white scales behind middle. Anterior slope of discal prominence densely covered with wider white scales. Sides also with small spot of brown scales above fore coxae. Scutellum dull pale brown on top, with white scales at base. Outer corner of mesepisternum with spot of black scales. Base of elytra with band of brown scales, intervals 1 and 2, preapical prominences, and sides in apical half, densely covered with broad white scales, middle of each elytron with sparser vestiture of white, linear to narrow-lanceolate scales, broader in striae. Legs mottled with spots of narrow and broad white scales, sternum 1 and base of sternum 2 with brown spot on sides. Pygidium with scales not extending beyond punctures, broadly oval to round on basal half and elongate, slightly raised near apex; brown scales predominant on basal half, white scales along margins, median line, and on apical half.

Body length 2.9–3.0, width 2.9 mm.

Female: Rostrum 1.25× as long as prothorax, moderately widened and angularly curved at antennal insertion, with dorsal outline angular in lateral view; apically straight, cylindrical, slender, about ⅔ width of fore tibia. Median carina shorter than in male; lateral carinae well developed. Antenna inserted 0.3 from base of rostrum.

Tibiae without mucro. Protarsomere one about 2.2× as long as broad, protarsomere two 1.2× as long as broad, protarsomere three 1.17× as long as protarsomere two.

Female genitalia: Arms of sternum 8 moderately short (Fig. 54). Coxite and stylus robust (Fig. 55). Stylus tapering apically. Spermathecal pump and ductal lobe forming moderately narrow loop. Apex of spermathecal pump bent in direction opposite of ductal lobe (Fig. 56).

Remarks.—*Parorobitis minutus* shares majority of the character states exhibited by *P. gibbus*. It can be distinguished by the darker scale pattern of the head, smaller size, shorter arms of sternum 8 (Fig. 54), robust coxite and stylus (Fig. 55), stylus tapering apically, spermathecal pump and ductal lobe forming rather narrow loop, apex of spermathecal pump bent in direction opposite of ductal lobe (Fig. 56), median lobe narrowing apically without abrupt widening horizontally, apical third without lateral patches of setae, and apodeme at base nearly as narrow as at apex (Fig. 60–62).

Etymology.—This specific epithet is based on the Latin adjective *minutus* = "small" and refers to the relatively small size of the body.

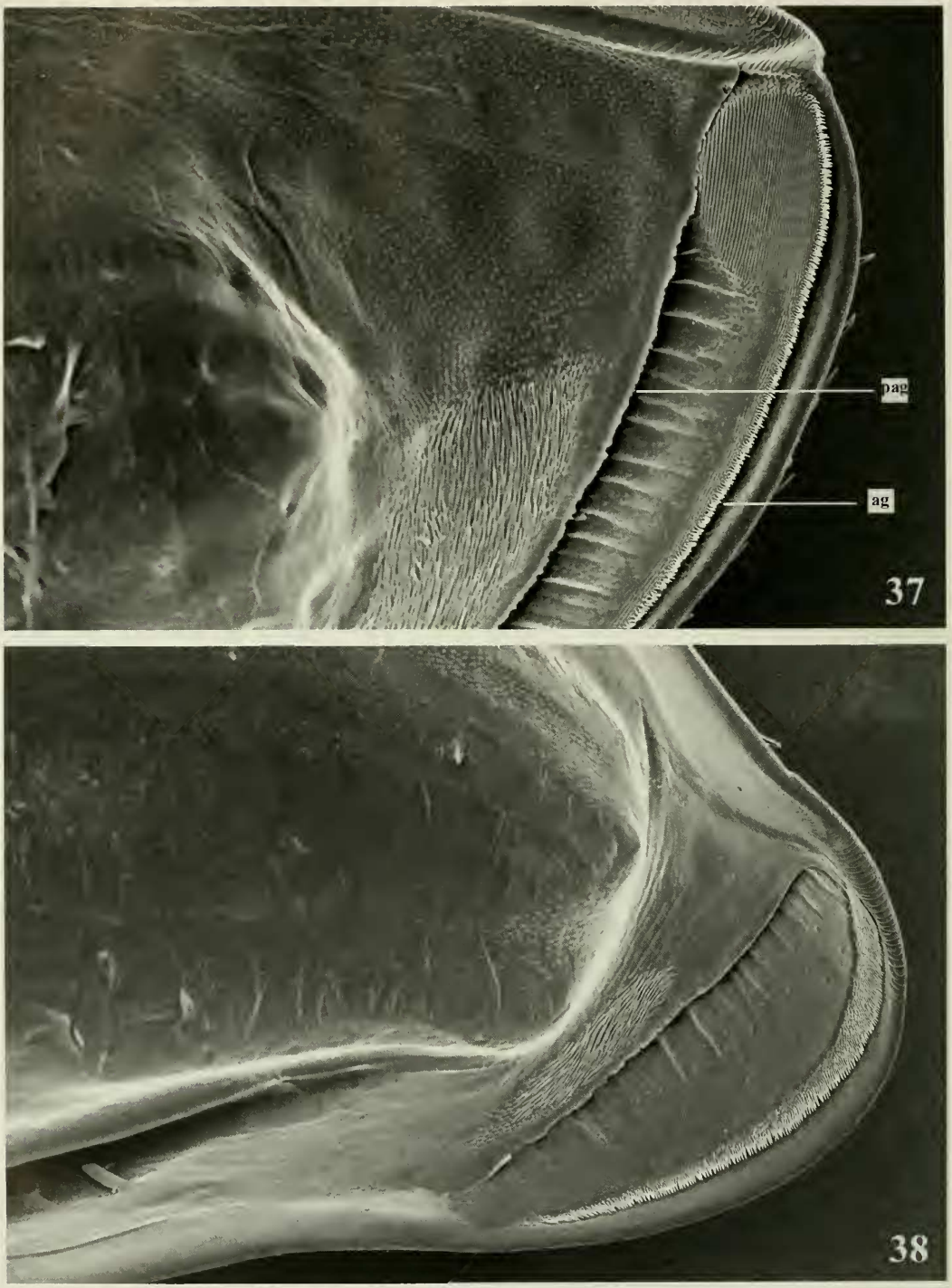


Fig. 37–38. Elytral apex with stridulatory file. 37, *Pachybaris porosa.* 38, *Lobotrachelus subfasciatus.* Abbreviations: ag = apical groove; pag = preapical groove.

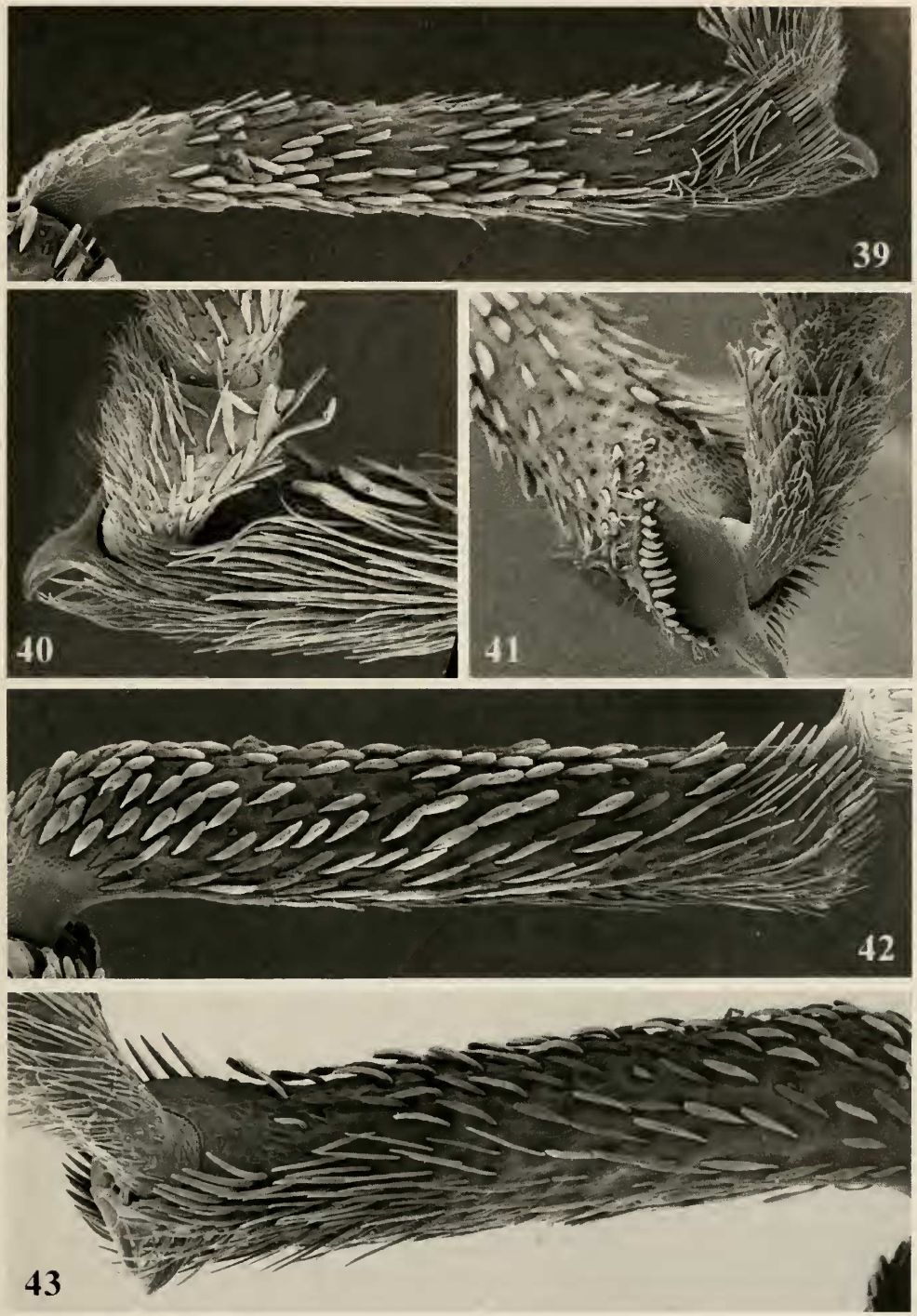


Fig. 39–43. Legs. 39–41, *Parorobitis gibbus*. 42, 43, *Orobitis cyaneus*. 39, Right metatibia, dorsal view. 40, 41, Tibial apex. 42, Right metatibia, dorsal view, 43, Right metatibia, ventral view.

Discussion

In spite of the sharp differences in appearance, *Orobitis* Germar and *Parorobitis* share many important characters including the following: unusual, extremely convex shape of body; rostrum weakly curved basally, apically straight; ventral surface of head without posterior tentorial pits and occipital sutures; antennal scrobe oblique, with ventral margin reaching venter of rostrum less than half way between antennal insertion and eye; mandibles with two denticles ventrally; labial palpi 2-segmented; prothorax subtrapezoidal, with base extremely wide and broadly rounded; mesepimera not visible from above, flat, deeply inserted between base of prothorax and elytra; prosternal sulcus formed by rather high lamelliform keels behind fore coxae; mesoscutellum with tall stalk; mesosternum and metasternum fused; elytra with strongly convex humeral prominences and sutural locking mechanism; apex of elytron with longitudinal stridulatory file (Figs. 35, 36); wings with well-developed R and radial fissure; legs long; claws with well developed median process (Figs. 46–48); abdominal sternum 1 nearly completely divided by hind coxae; pleurum 1 long, separated from tergum 1 by groove, attached to metepisternum by wide membrane with granulated microsculpture (Figs. 24). One of the most convincing pieces of evidence for the close relationships between *Orobitis* and *Parorobitis* is the structure of the stridulatory device. According to Lyal and King (1996), *Orobitis* has a unique file isolated from surrounding sculpture and placed on a different part of the elytron (Figs. 28, 36). Based on these observations, Lyal and King (1996) suspected that the file of *Orobitis* is non-homologous with files of other weevils (Figs. 37, 38). *Parorobitis* shares all the distinctive characters of the stridulatory file of *Orobitis* (Figs. 27, 35).

The differentiation between the two genera is most evident in the gestalt. The strongly developed relief of the exoskeleton in *Parorobitis* readily distinguishes it from species of *Orobitis.* Perhaps this indicates greater development of thoracic muscles, possibly due to a much more active flight behavior in the species of the new genus.

The systematic relationships of the Orobitidinae are uncertain. Colonnelli (1984: 207) placed *Orobitis* in the Ithyporinae [previously considered a tribe of the Cryptorhynchinae (Hustache 1936)], and cited Hustache (1936) as justification for the placement. This is actually incorrect as Hustache does not deal with *Orobitis* in the Coleopterorum Catalogus, but only cites the original placement of *Cleogonus nuculus* (Germar) in the genus *Orobitis,* which has nothing to do with the systematic position of *Orobitis.* Zherikhin and Egorov (1990: 113) treat Orobitini as a tribe of the Baridinae (which according to them also includes Ceutorhynchini, Zygopini, and Trigonocolini).

Zherikhin and Gratshev (1995) elevated Baridinae to family, but there are some problems with this taxonomic decision. Among the synapomorphies of Barididae *sensu* Zherikhin et Gratshev, the presence of the median keel on the inner surface of metasternum seems the primary character. However, this is shared by other apparently very different groups and its distribution in combination with other characters should be studied. The first character in the wing structure listed by Zherikhin and Gratshev (1995: 773), among the most important synapomorphies of the Baridinae, is the strongly curved basal wing margin. However this character state is more developed in the Zygopinae and Ceutorhynchinae (Zherikhin and Gratshev 1995, Figs. 108–121), than in Baridinae (see Figs. 122–132 in the same work). Trigonocolinae do not possess a critical diagnostic character which distinguishes Ceutorhynchinae, Zygopinae, and Baridinae from the rest of Curculionidae, i.e., the dorsally visible mesepimera, and it is not clear that this character state should be considered to be a secondary loss in Trigonocolinae as presumed by Zheri-

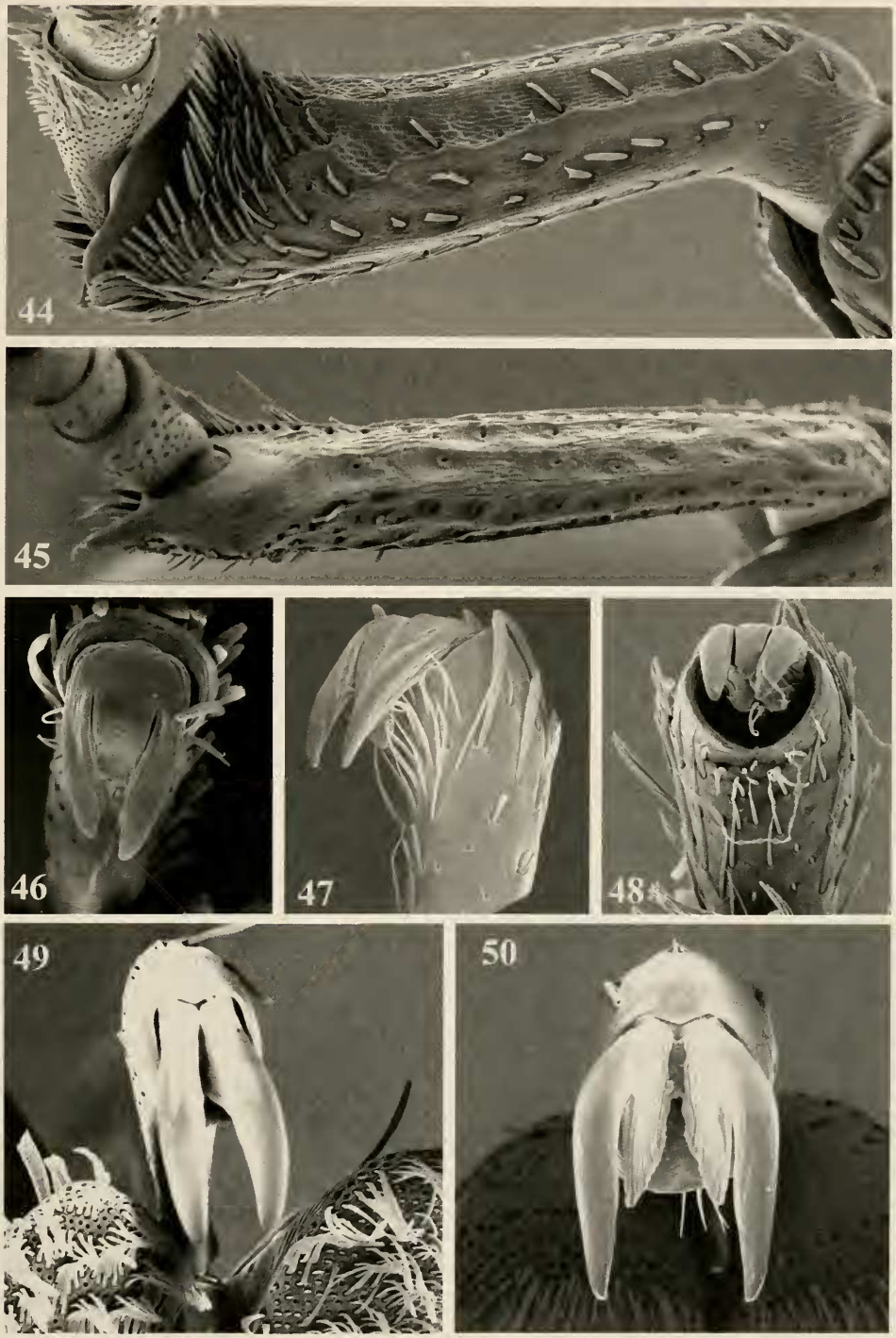


Fig. 44–50. Legs. 44, *Pachybaris porosa,* right metatibia, ventral view. 45, *Lobotrachelus subfasciatus,* right metatibia, ventral view. 46–50. Claw. 46, 47, *Parorobitis gibbus.* 48, *Orobitis cyaneus.* 49, *Pachybaris porosa.* 50, *Lobotrachelus subfasciatus.*

khin and Egorov. The large to very large scutellum, the presence of the wax powder secretion, and the often carinate elytral intervals of *Trigonocolus* do not fit the diagnosis of the Baridiidae. Also Zherikhin and Gratshev (1995) give no evidence from the wing structure of close affinity of Trigonocolinae with the other 4 subfamilies. We prefer to consider Trigonocolinae as short-bodied representatives of the phyletic branch also including Mecyslobini, Magdalini, and Carciliini (i.e., Molytinae in recent classifications) rather than to place them close to Orobitidinae, Ceutorhynchinae, Baridinae, or Zygopinae. Each of the last four groups can be clearly identified and is very different from each other. Except for the Orobitidinae, the other taxa have very large numbers of genera and species and are distributed worldwide. Thus it seems that additional data is needed for treating Baridinae, Ceutorhynchinae, Zygopinae and Orobitidinae as members of a single natural group. Until the presence of a longitudinal keel on the metasternum is shown to be a true synapomorphy, through rigorous character analysis, there is no reason to consider Baridiidae *sensu* Zherikhin and Egorov (1990) and Zherikhin and Gratshev (1995) to be a natural group.

Detailed comparative analysis of the taxa considered is far beyond the aim of this paper and needs examination of much greater number of taxa and structures. However, we would like to summarize here some characters of the Orobitidinae and their supposed relatives. We believe that revealing clear distinctions will allow better understanding of the groups, rather than lumping them together based on characters whose synapomorphic value has not been proven.

Key for Differentiation of the Orobitidinae and Weevil Subfamilies with Dorsally Visible Mesepimera:

1 (2). Mesepimera not clearly visible from above. Meso- and metasterna fused. Abdominal sternum 1 not longer than 2, nearly completely divided by hind coxae. Rostrum more or less bent at antennal insertion, straight or nearly straight in apical part, always narrower than basal part; not separated from frons by sulcus. Claws with appendages fused into entire flat process half as long or nearly as long as claws themselves. Body globose or subrhomboidal, very strongly convex dorsally. 1.8–3.5 mm. Palearctic and Neotropics . . . . . Orobitidinae

2 (1). Mesepimera usually clearly visible from above (not visible in Palearctic species of *Baris* Germar developing on crucifers and in some southern Asian and South African Ceutorhynchinae with subconical, strongly apically narrowing prothorax). Meso- and metasterna not fused, separated by distinct suture. Abdominal sternum 1 longer than 2, never nearly completely divided by hind coxae. Rostrum not conspicuously bent at antennal insertion. Claws simple, toothed, or appendiculate, in latter case appendages not fused in an entire flat median process. Body shape variable 3

3 (4). Prosternum with median sulcus for reception of rostrum, often prolonged on meso- or metasternum, and with more or less developed keels in front of fore coxae. Males always without horn-like projections on prosternum before coxae and without fovea between them. Head capsule not spherical, but transverse or slightly flattened dorsoventrally. Rostrum not separated from head capsule by sulcus, neither conspicuously tapering apically nor dilated to base. Antennal funicle often with fewer than 7 flagellomeres. Eyes usually more or less convex, always separated on frons (usually by not less than twice width of antennal scape). Pronotum often with raised anterior margin and with lateral (and often also discal) tubercles. Basal margin of pronotum often raised conjointly with basal margins of elytra and crenulate. Scutellum small to minute, never transverse or subcordate. Elytra usually broad, slightly longer than broad, in tropical species often broader than long. Lateral margin of elytron more or less angularly emarginate above anterior part of metepisterna, latter projecting dorsally. Many species apterous in temperate zones. Hind femora broadest, often saltatorial. Tibiae mutic (except in some *Zacladus* Reitter and *Scleropterus* Schoenherr), mucro usually developed on middle and hind tibiae in males, but often also on fore tibiae; in xerophilous species with narrow tarsi, females may have longer mucro. Claws usually toothed or appendiculate, often

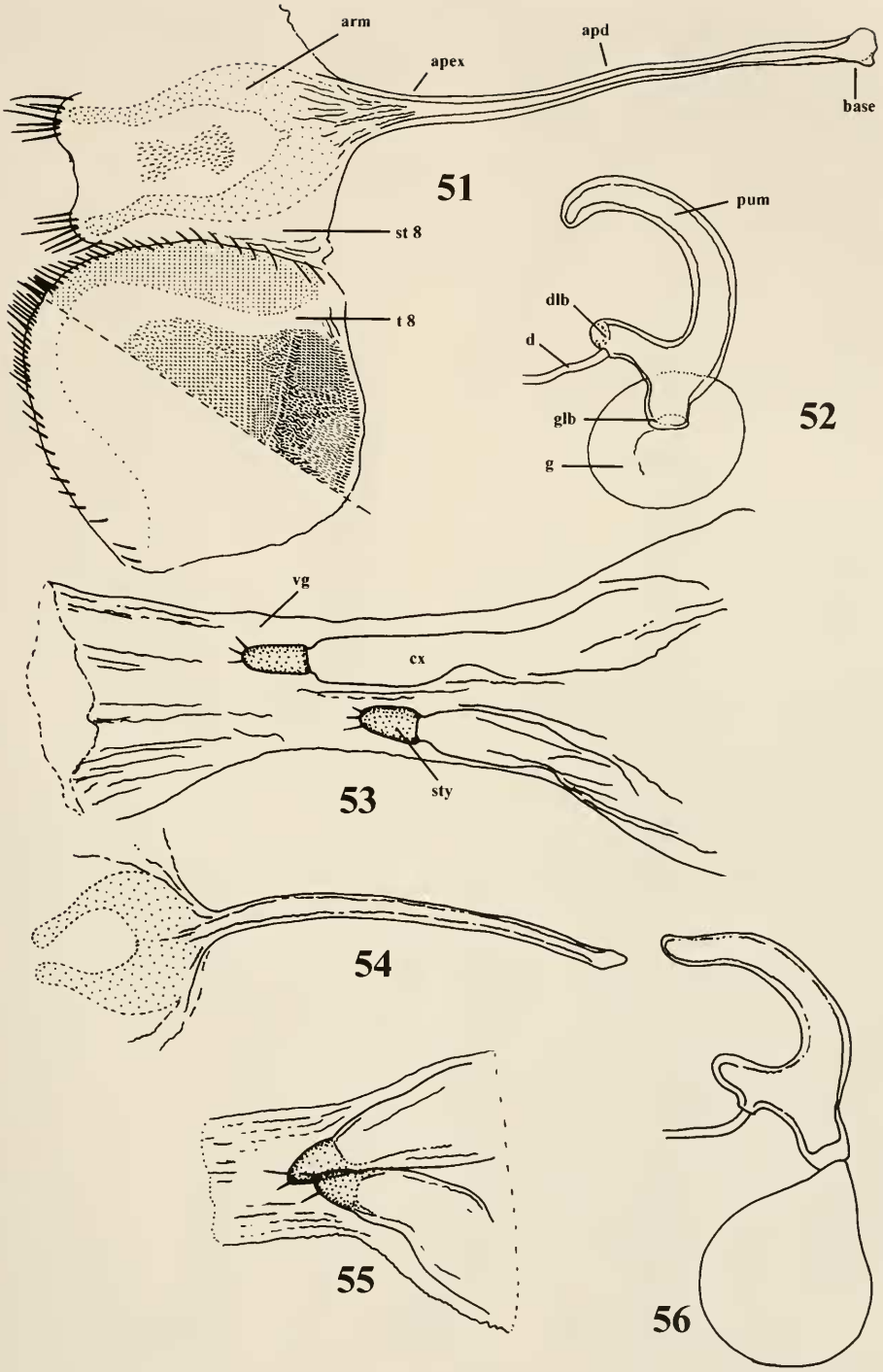


Fig. 51–56. Female genitalia. 51–53, *Parorobitis gibbus*. 54–56, *Parorobitis minutus*. 51, Sternite and tergite 8. 52, 56, Spermatheca. 53, 55, Vagina with coxites and styli. 54, Sternite 8. Abbreviations: 8 st = sternite 8; 8 t = tergite 8; arm = arm of sternite 8; apd = apodeme of sternite 8; cx = coxite; d = duct; dlb = ductal lobe; g = gland; glb = gland lobe; sty = stylus; vg = vagina.

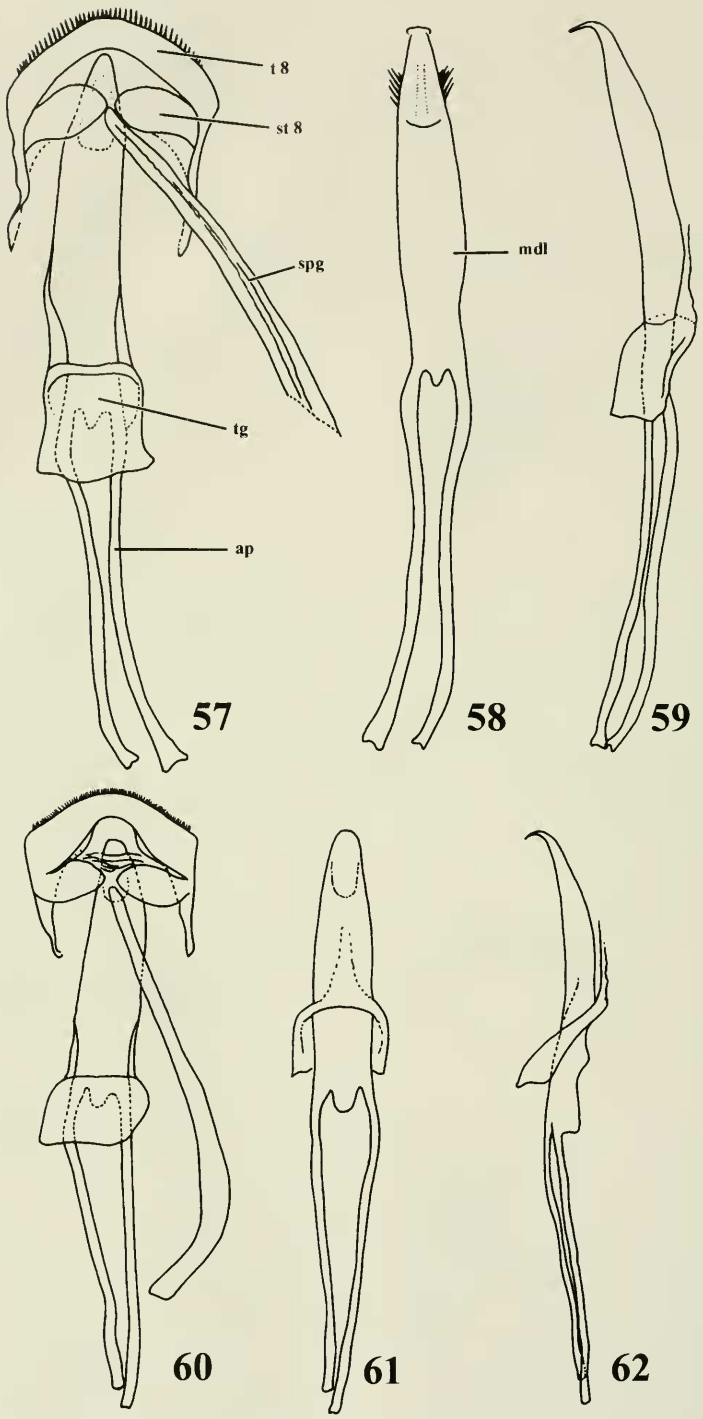


Fig. 57–62. Male genitalia and tergite 8. 57–59, *Parorobitis gibbus*. 60–62, *Parorobitis minutus*. 57, 60, Tergite 8 and aedeagus, ventral view. 58, 61, Dorsal view. 59, 62, Lateral view. Abbreviations: 8 st = sternite 8; 8 t = tergite 8; ap = apodeme; mdl = median lobe; spg = spiculum gastrale; tg = tegmen.

connate; rarely single. Pygidium exposed except in Palearctic *Trichosirocalus* Colonnelli. Host plants mostly herbaceous or lianas, larvae develop in non lignified tissue. 1.5–7.0 mm. World-wide including Arctic (but not Subantarctic) tundra . . . . . Ceutorhynchinae

4 (3). Prosternum usually without median sulcus for reception of rostrum, without keels in front of fore coxae (except in Lobotrachelini, Zygopinae). Prosternum in males sometimes with horn-like projections before coxae and deeply foveate between them. Head capsule spherical or transverse. Rostrum usually separated from head capsule by sulcus and/or more or less strongly widening to base, often also tapering and flattened apically. Antennal funicle usually with 7 flagellomeres. Eyes often flat, broadly separated or contiguous. Anterior margin of pronotum never raised, sides without tubercles, disc more or less evenly convex, sometimes with median tubercle, but not sulcate. Basal margins of pronotum and elytra neither raised conjointly nor crenulate. Scutellum small to large, often convex, transverse or subcordate. Elytra often much longer than broad. Lateral margin of elytron shallowly sinuate, not conspicuously emarginate above anterior part of metepisterna. Wings usually functional except in herpetobiont species. Fore femur usually broadest, often strongly enlarged and dentate- then fore tibia strongly bent; legs not saltatorial. Tibiae uncinate; in males, often also mucronate. Claws usually simple, free or connate; rarely single. Pygidium exposed or concealed. Host plants herbs, very often lianas and trees, larvae often in lignified tissue. 0.9–35 mm. Worldwide except northern taiga and tundra 5

5 (6). Eyes contiguous or subcontiguous, very large, flat, limited to dorsal half on head capsule, not visible ventrally. Head capsule at least slightly transverse. Rostrum not separated from head capsule by sulcus, more or less widening to base, often tapering and flattened apically. (In Lobotrachelini, Zygopinae, prosternum deeply sulcate, body polished, globose, legs subulate.) Elytra elongate to transverse, usually flattened dorsally, never glabrous or metallic, usually with scales. Wings usually functional. Venter more or less strongly oblique to apex in lateral view. Femora often dentate, fore femur often strongly enlarged, then tarsus elongated, especially in males. Claws usually free, simple or toothed. Predominantly tropical and subtropical . . . . . Zygopinae

6 (5). Eyes widely separated on frons, always approximate ventrally. Head capsule spherical. Rostrum usually separated from frons by sulcus. Prosternum rarely deeply sulcate for reception of rostrum. Elytra usually elongate, in many tropical forms short or subglobose, body then often glabrous or metallic. Vestiture often reduced or absent. Wings reduced in herpetobiont forms. Venter not conspicuously oblique apically in lateral view. Femora usually unarmed, fore femur rarely strongly enlarged. Claws often connate, rarely toothed or single. World-wide except northern taiga and tundra . . . . . Baridinae

Acknowledgments

We thank O. Merkl of the Hungarian Museum of Natural History (HMNH) for the opportunity to study material in his care. The other depositories of the type material are abbreviated as follows: C. W. O'Brien collection, Florida A & M University, Tallahassee, FL (CWOB); National Museum of Natural History, Smithsonian Institution, Washington, DC (USNM); Zoological Institute, Russian Academy of Sciences, St. Petersburg (ZIN); Federal University of Parana, Curitiba, Brazil (OZUP). We are also grateful to T. L. Erwin (Department of Entomology, National Museum of Natural History, Washington, DC), A. Norrbom, and N. Woodley (Systematic Entomology Laboratory, ARS, USDA, Washington, DC) for reviewing this manuscript and providing valuable suggestions. Research by B. Korotyaev was funded in part by Russian Federation for Basic Research, Grant # 98-04-49763. Research by C. W. O'Brien was funded in part by the USDA's Cooperative State Research, Education and Extension Service (FLAX 910001).

Literature Cited

Colonnelli, E. 1984. Notes sur quelques Ceutorhynchinae de l'Afrique tropicale (Coleoptera, Curculionidae). Annales Historico-Naturales Musei Nationalis Hungarici 76: 207–238.

Crowson, R. A. 1955. The Natural Classification of the Families of Coleoptera. Lloyd, London, viii+187

pp. [Reprinted from Entomologist's Monthly Magazine, 1950–1954].

Howden, A. T. 1995. Structures related to oviposition in Curculionoidea, pp. 53–100. *In* Anderson, R. S. and C. H. Lyal, eds., Biology and Phylogeny of Curculionoidea: Proceedings of a symposium convened at the XVIII International Congress of Entomology, Vancouver, Canada, July 3–9, 1988. Memoirs of the Entomological Society of Washington. 14, 174 pp.

Hustache, A. 1936. Curculionidae: Cryptorrhynchinae. Coleopterorum Catalogus. W. Junk, 's-Gravenhage. 151, 317 pp.

Konstantinov, A. S. 1998. Revision of the Palearctic species of *Aphthona* Chevrolat and cladistic classification of the Aphthonini (Coleoptera: Chrysomelidae: Alticinae). Memoirs on Entomology, International, Associated Publishers, Gainesville. 429 pp. + 608 figs.

Konstantinov, A. and N. Vandenberg. 1996. Handbook of Palearctic flea beetles (Coleoptera: Chrysomelidae: Alticinae). Contributions on Entomology, International 1(3): 237–439.

Kukalová-Peck, J. and J. F. Lawrence. 1993. Evolution of the hind wing in Coleoptera. The Canadian Entomologist 125: 181–258.

Lyal, C. H. C. 1993. Cryptorhynchinae (Insecta: Coleoptera: Curculionidae). Fauna of New Zealand. Manaaki Whenua Press, Lincoln, Canterbury, New Zealand. 29, 305 pp.

Lyal, C. H. C. and T. King. 1996. Elytro-tergal stridulation in weevils (Insecta: Coleoptera: Curculionoidea). Journal of Natural History 30: 703–773.

McHugh, J. V., C. J. Marshall, and F. L. Fawcett. 1997. A study of morphology in *Megalodacne heros* (Say) (Coleoptera: Erotylidae). Transactions of the American Entomological Society 123(4): 167–223.

Matsuda, R. 1970. Morphology and evolution of the insect thorax. Memoirs of the Entomological Society of Canada 76, 431 pp.

Morimoto, K. 1962. Comparative morphology and phylogeny of the superfamily Curculionoidea in Japan. (Comparative morphology, phylogeny and systematics of the superfamily Curculionoidea of Japan I). Journal of the Faculty of Agriculture, Kyushu University 11: 331–373.

O'Brien, C. W. and I. S. Askevold. 1995. Systematics and evolution of weevils of the genus *Bagous* Germar (Coleoptera: Curculionoidea), V. Taxonomic treatment of the species of the Indian subcontinent. Contributions of the American Entomological Institute 28(5), 182 pp.

Smith, E. H. 1979. Techniques for the dissection and mounting of the male (aedeagus) and female (spermatheca) genitalia of the Chrysomelidae (Coleoptera). Coleopterists Bulletin 33(1): 93–103.

Thompson, R. T. 1989. Terminology of the spermatheca—A protest. Curculio 26: 3–4.

Zherikhin, V. V. and A. B. Egorov. 1990. Weevils (Coleoptera, Curculionidae) of the Far East of the USSR (a review of the subfamilies with a description of a new taxa). Academy of Sciences, Far Eastern Branch, Vladivostok, 164 pp.

Zherikhin, V. V. and V. G. Gratshev. 1995. A comparative study of the hind wing venation of the superfamily Curculionoidea, with phylogenetic implications, pp. 633–777. *In* Pakaluk, J. and S. A. Ślipiński, eds., Biology, phylogeny, and classification of Coleoptera: Papers celebrating the 80th birthday of Roy A. Crowson. Muzeum I Institut Zoologii PAN, Warszawa. 1,092 pp.